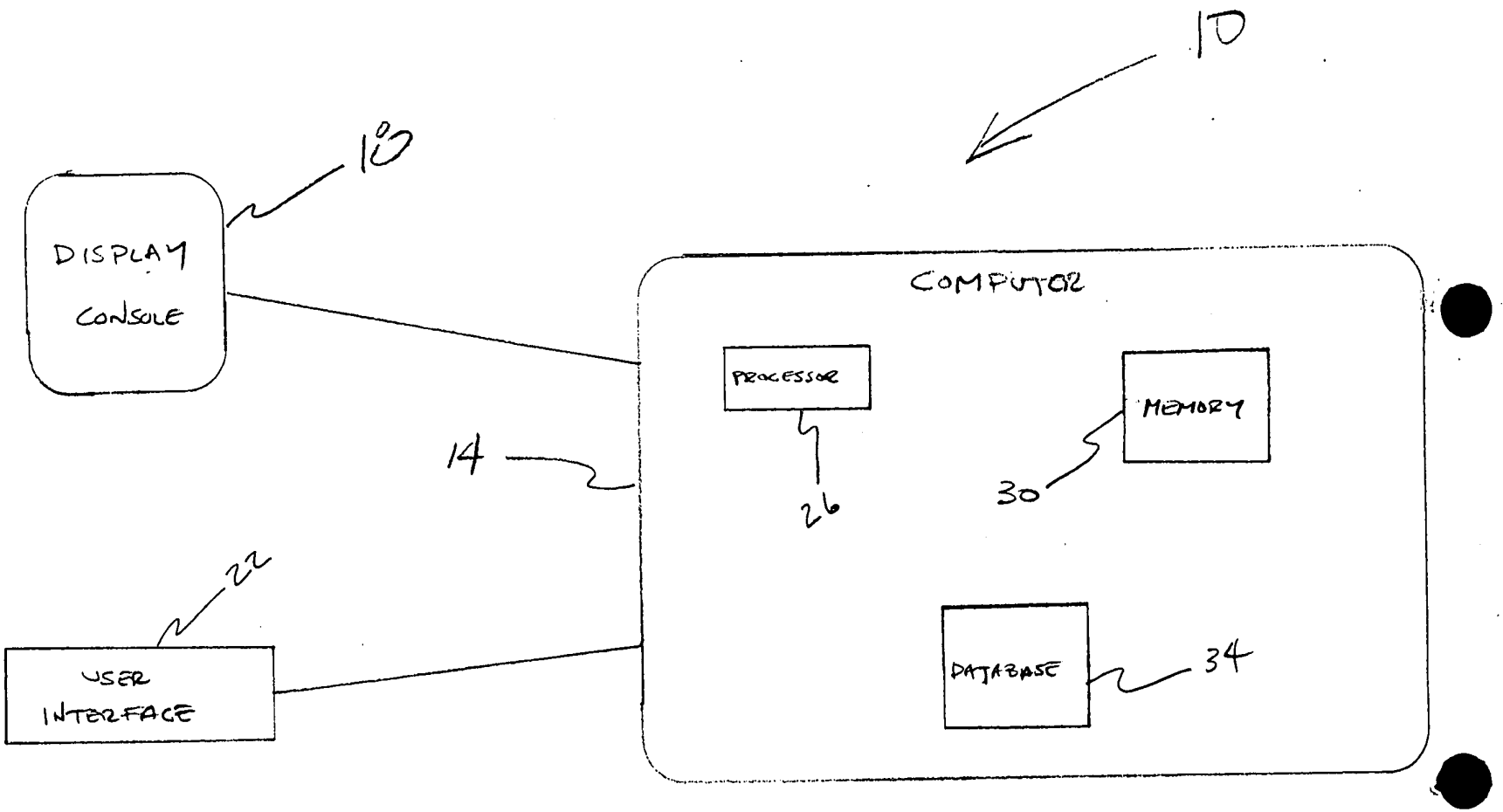
10
12
DISPLAY CONSOLE
COMPUTER
PROCESSOR
26
14
MEMORY
30
22
USER INTERFACE
DATABASE
34

Fig. 1

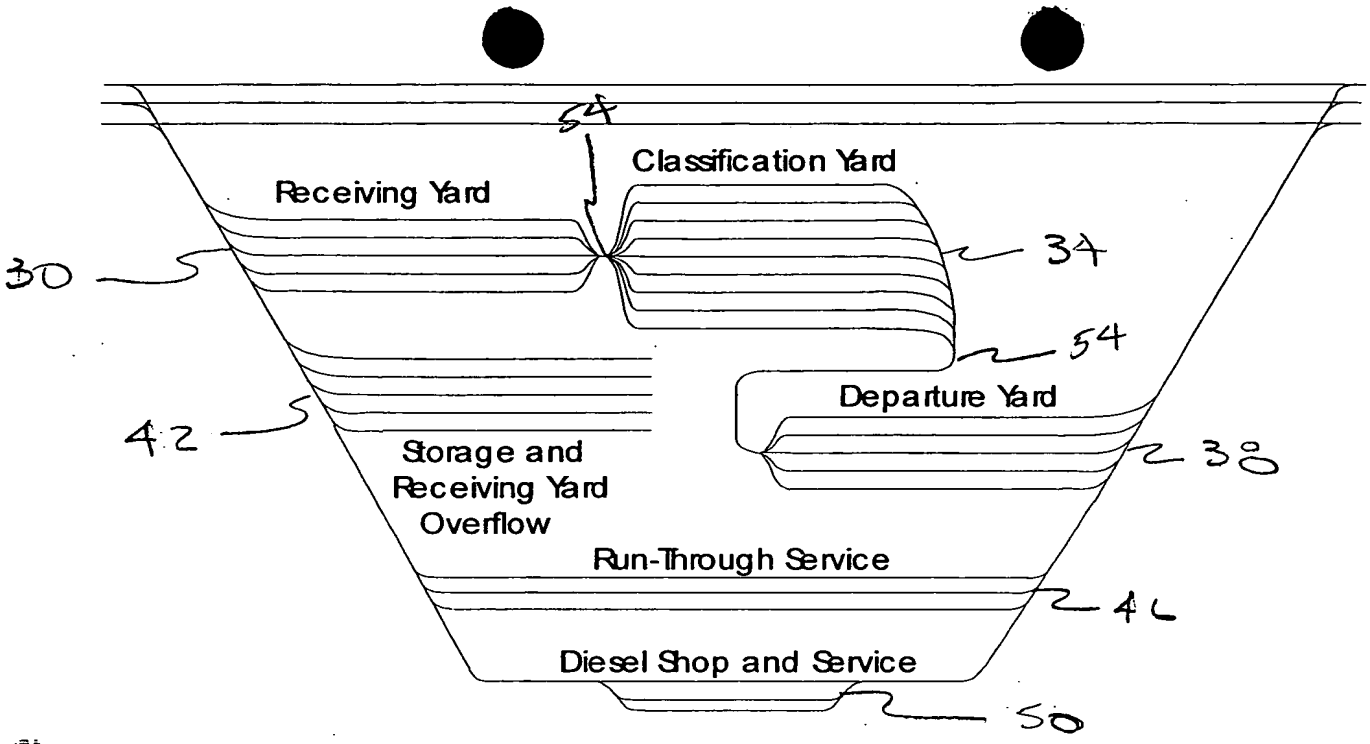
54
Classification Yard
Receiving Yard
30
34
54
Departure Yard
42
38
Storage and
Receiving Yard
Overflow
Run-Through Service
46
Diesel Shop and Service
50

Fig. 2

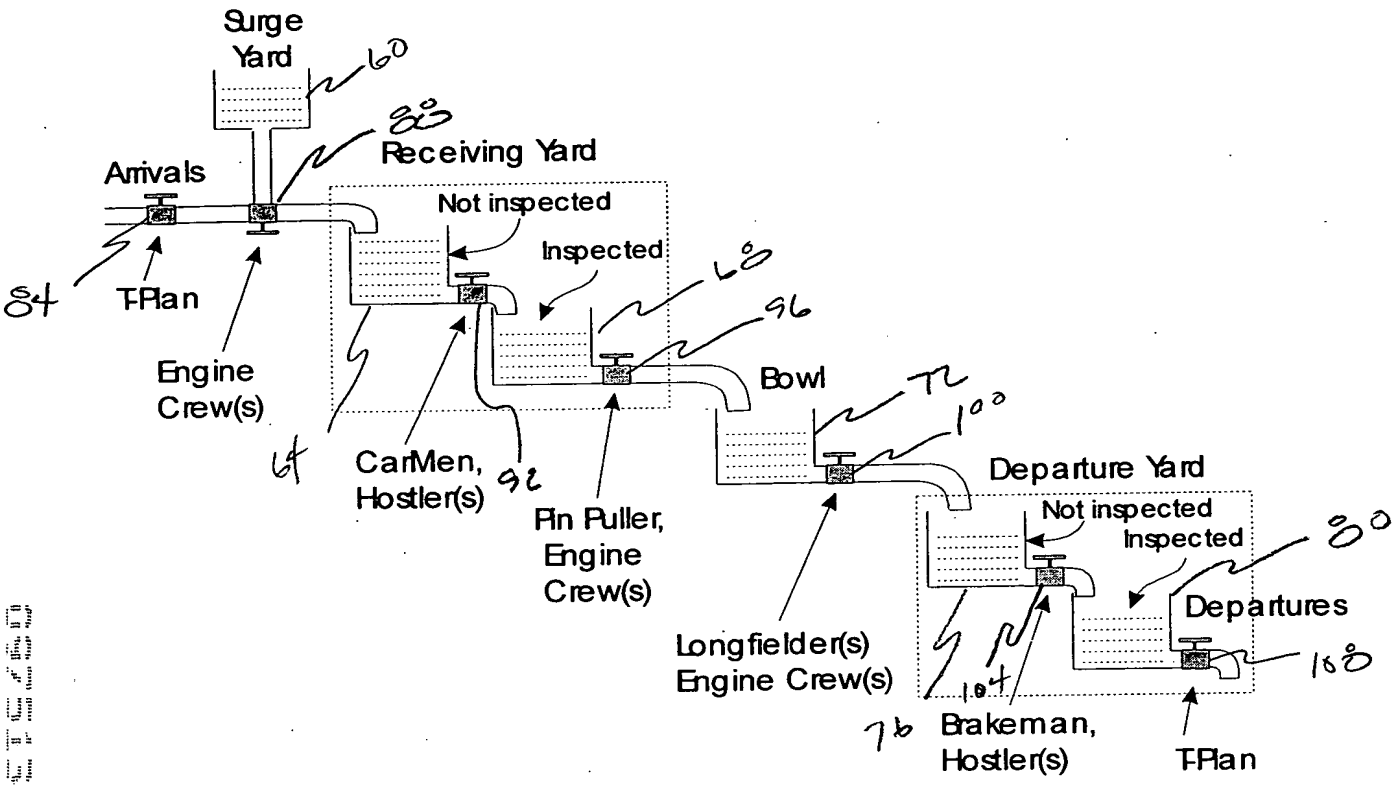
Surge Yard
60
Receiving Yard
Arrivals
Not inspected
Inspected
84
T-Plan
Engine Crew(s)
64
CarMen, Hostler(s)
92
Pin Puller, Engine Crew(s)
68
96
Bowl
72
100
Departure Yard
Not inspected
Inspected
80
Departures
108
Longfielder(s) Engine Crew(s)
104
76
Brakeman, Hostler(s)
T-Plan

Fig. 3

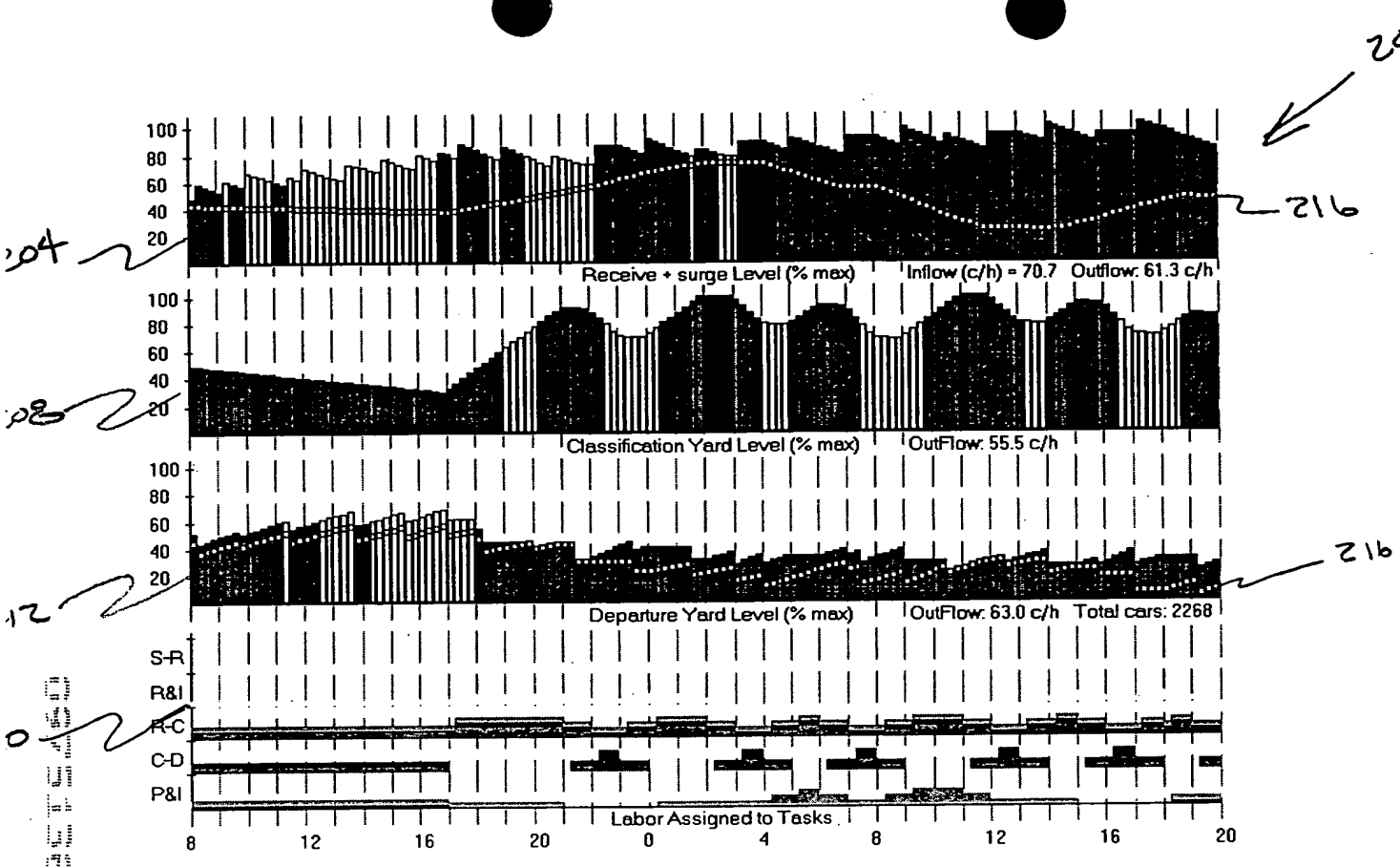
200
216
Receive + surge Level (% max)
Inflow (c/h) = 70.7 Outflow: 61.3 c/h
Classification Yard Level (% max)
OutFlow: 55.5 c/h
216
Departure Yard Level (% max)
OutFlow: 63.0 c/h Total cars: 2268
S-R
R&I
R-C
C-D
P&I
Labor Assigned to Tasks
100
80
60
40
20
8
12
16
20
0
4
8
12
16
20

Fig. 4

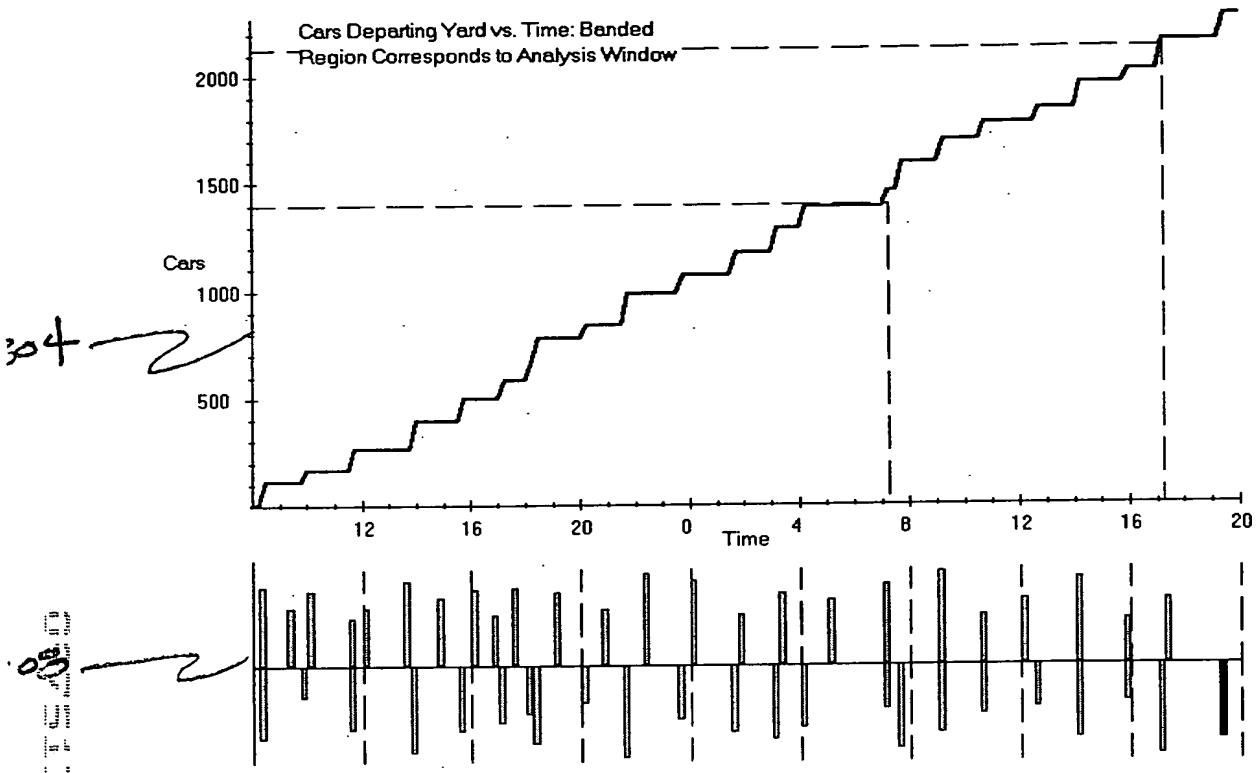
Cars Departing Yard vs. Time: Banded
Region Corresponds to Analysis Window
2000
1500
Cars
1000
500
12
16
20
0
4
8
12
16
20
Time
300
304

Fig. 5

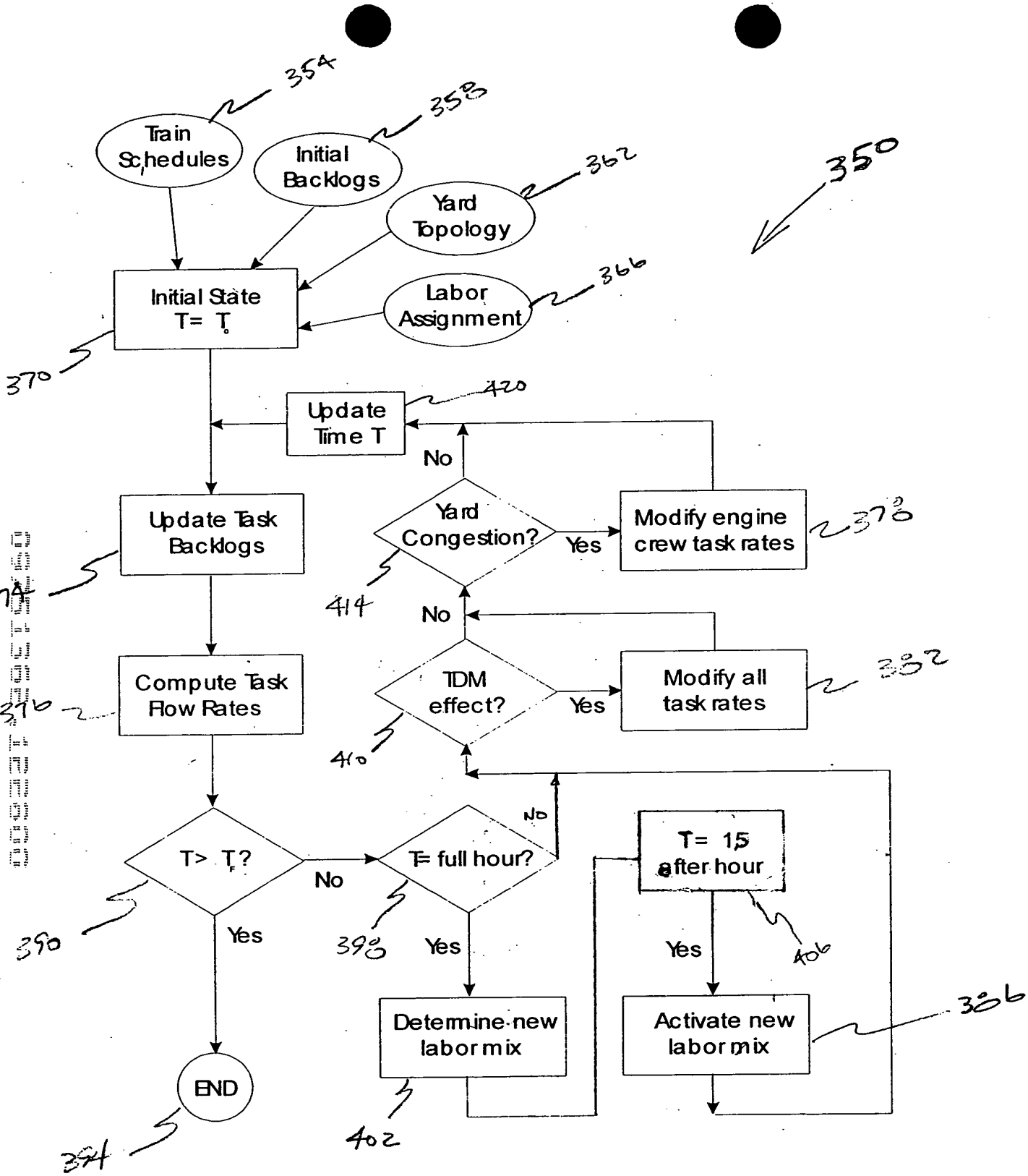
354
Train Schedules
358
Initial Backlogs
362
Yard Topology
350
Initial State T= T0
366
Labor Assignment
370
420
Update Time T
No
Update Task Backlogs
Yard Congestion?
Yes
Modify engine crew task rates
372
374
414
No
Compute Task Flow Rates
TDM effect?
Yes
Modify all task rates
352
376
410
No
T> Tf?
No
T= full hour?
T= 15 after hour
390
Yes
398
Yes
Yes
406
Determine new labor mix
Activate new labor mix
306
END
354
402

Fig. 6

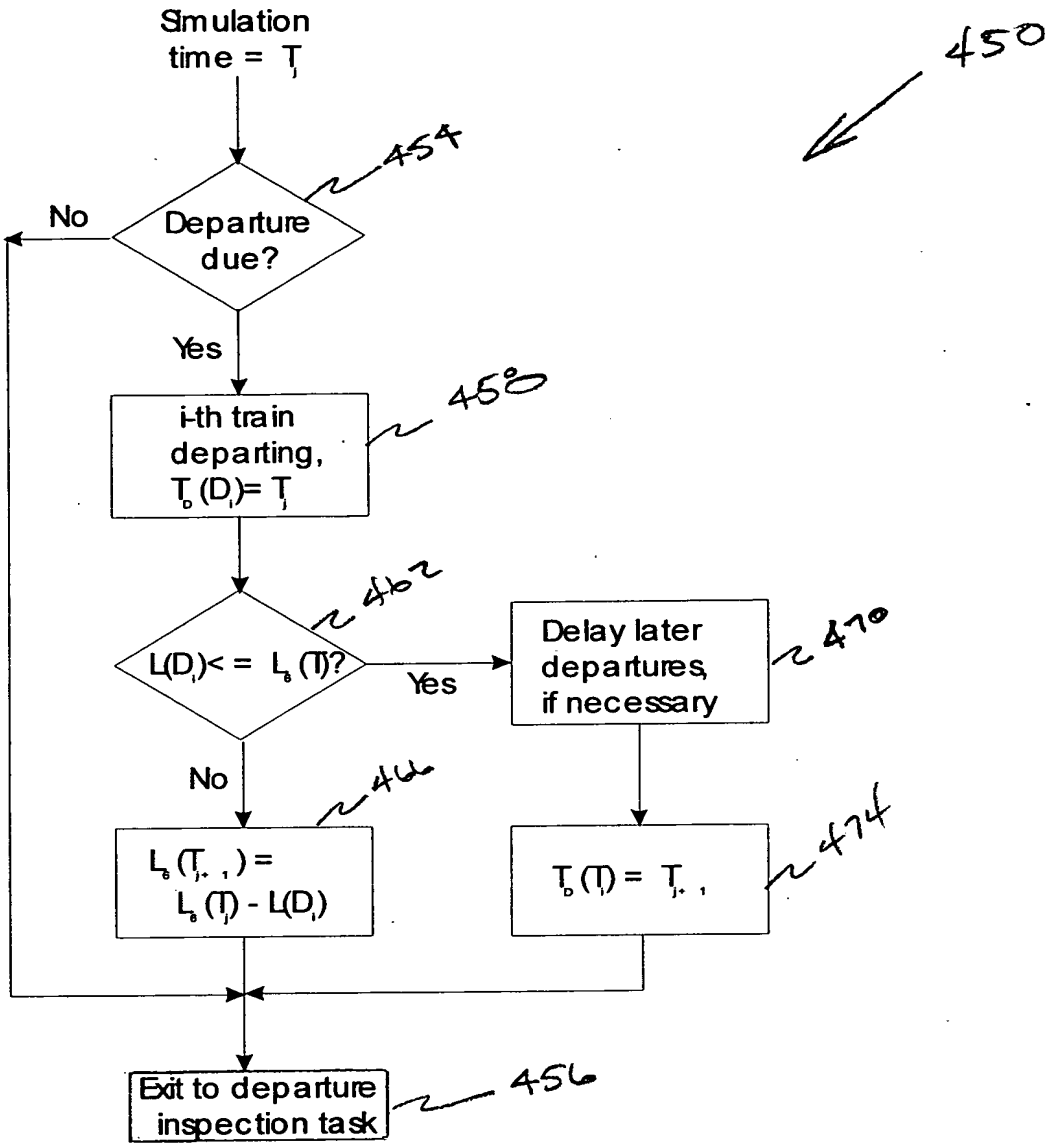
Simulation time = T_j
450
454
Departure due?
No
Yes
458
i-th train departing, $T_D(D_i) = T_j$
462
$L(D_i) <= L_s(T_j)$?
Yes
470
Delay later departures, if necessary
No
466
$L_s(T_{j+1}) = L_s(T_j) - L(D_i)$
474
$T_D(T_i) = T_{j+1}$
Exit to departure inspection task
456

Fig. 7

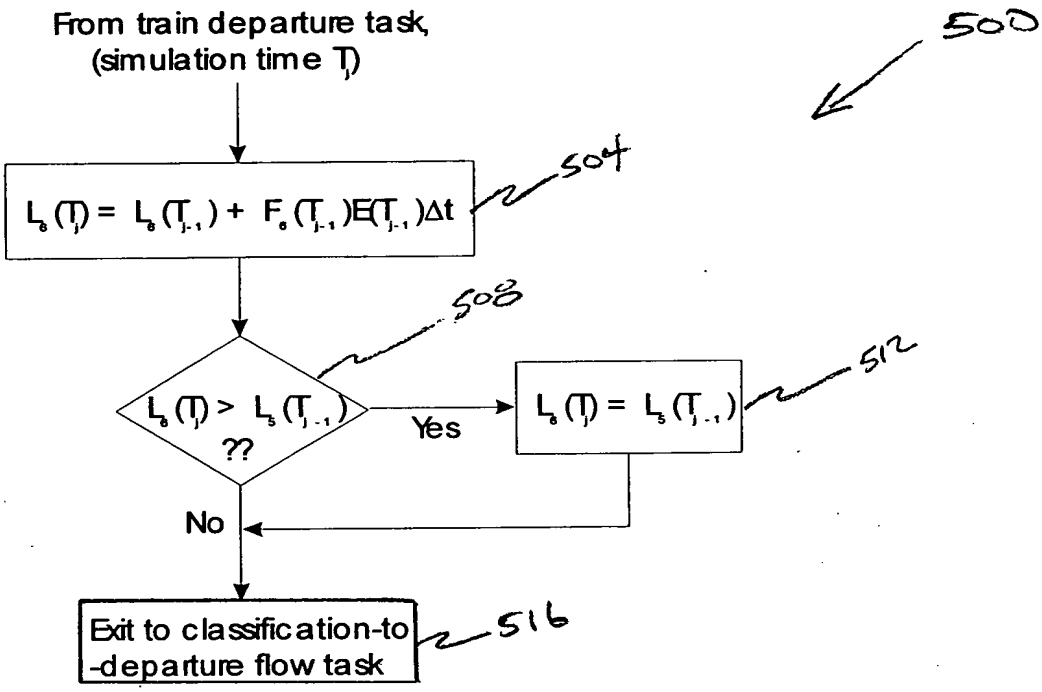
From train departure task, (simulation time T_j)
500
$L_s(T_j) = L_s(T_{j-1}) + F_s(T_{j-1})E(T_{j-1})\Delta t$
504
508
$L_s(T_j) > L_s(T_{j-1})$??
Yes
$L_s(T_j) = L_s(T_{j-1})$
512
No
Exit to classification-to-departure flow task
516

Fig. 8

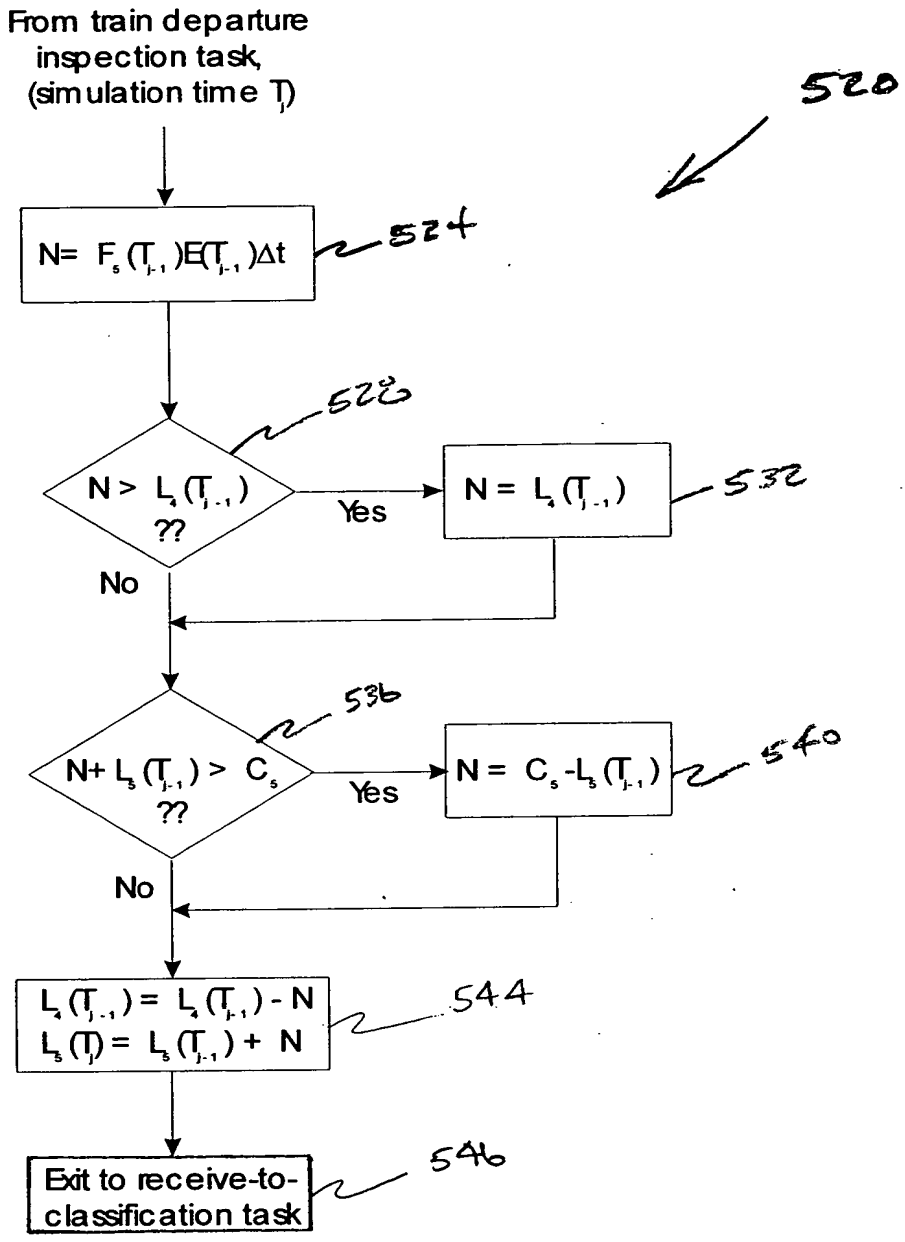
From train departure inspection task, (simulation time T_j)
520
$N = F_5(T_{j-1})E(T_{j-1})\Delta t$
524
$N > L_4(T_{j-1})$??
528
Yes
$N = L_4(T_{j-1})$
532
No
$N + L_5(T_{j-1}) > C_5$??
536
Yes
$N = C_5 - L_5(T_{j-1})$
540
No
$L_4(T_j) = L_4(T_{j-1}) - N$
$L_5(T_j) = L_5(T_{j-1}) + N$
544
Exit to receive-to-classification task
546

Fig. 9

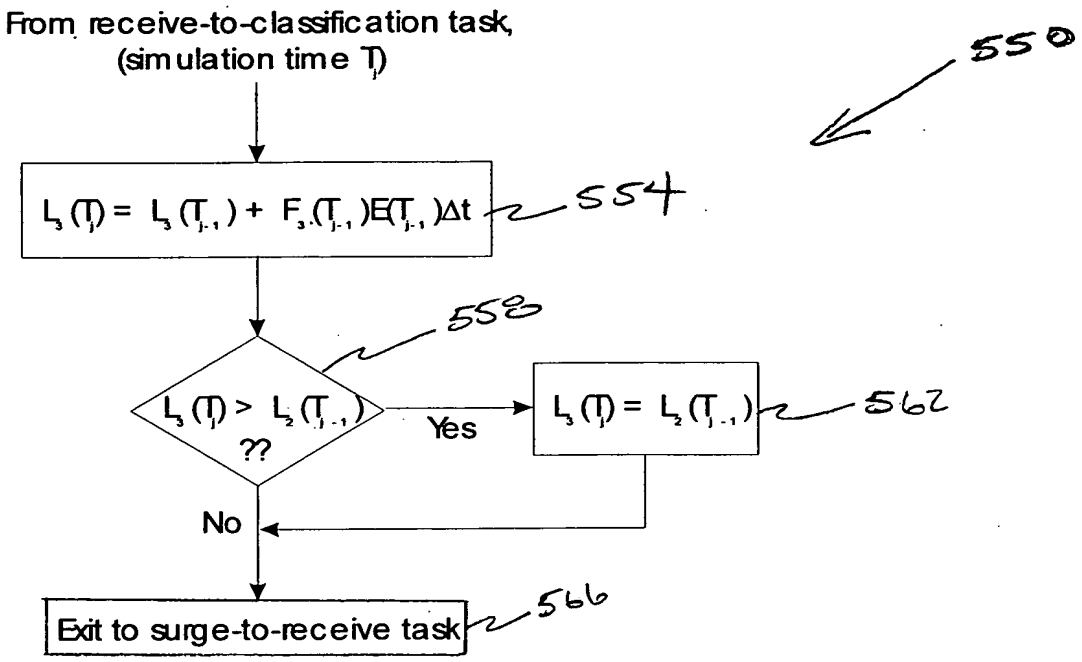
From receive-to-classification task, (simulation time T_j)
550
$L_3(T_j) = L_3(T_{j-1}) + F_{3,2}(T_{j-1})E(T_{j-1})\Delta t$
554
558
$L_3(T_j) > L_2(T_{j-1})$??
Yes
$L_3(T_j) = L_2(T_{j-1})$
562
No
Exit to surge-to-receive task
566

Fig. 10

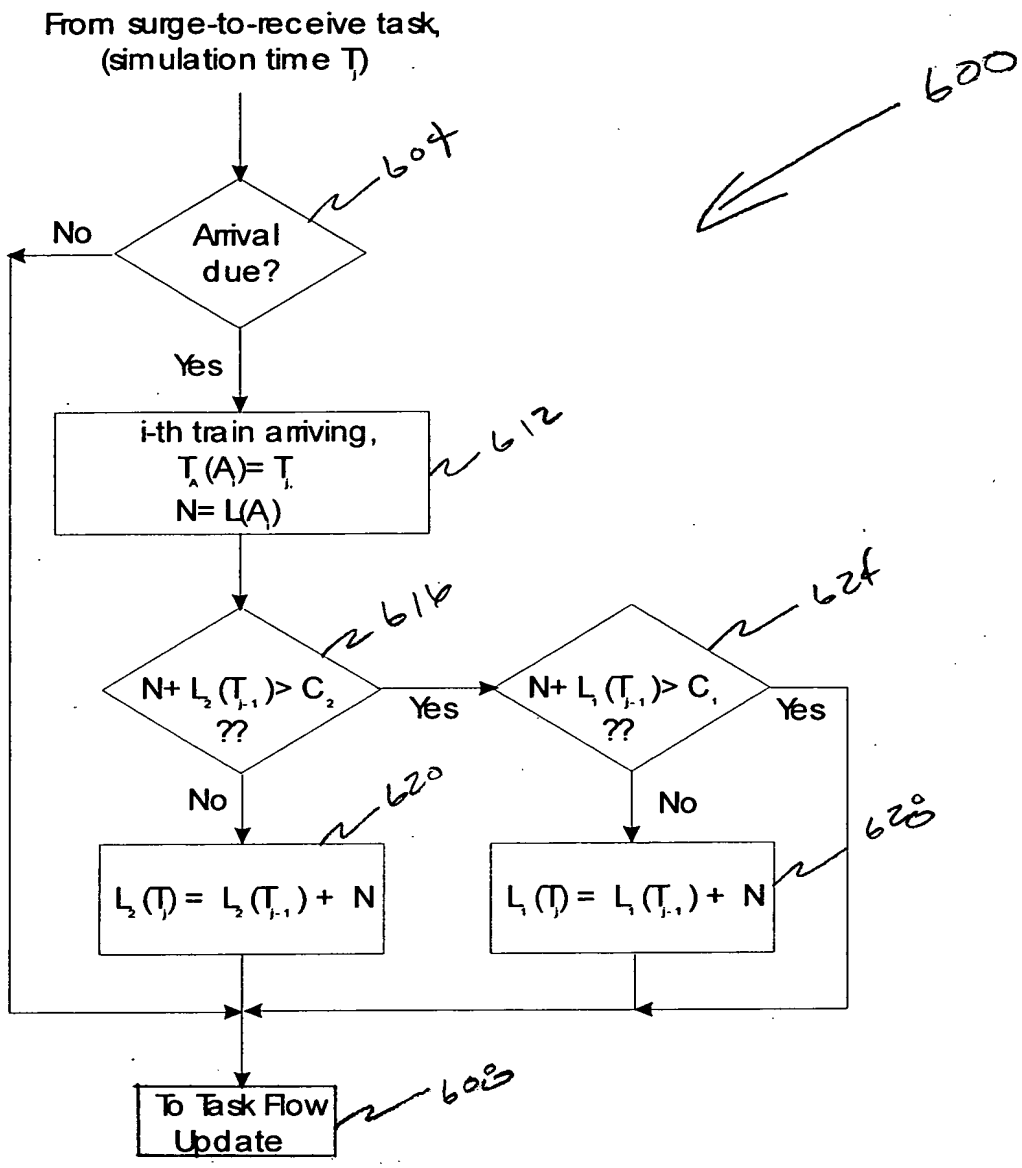
From surge-to-receive task, (simulation time T_j)
600
604
Arrival due?
No
Yes
612
i-th train arriving, $T_A(A_i) = T_j$ $N = L(A_i)$
616
$N + L_2(T_{j-1}) > C_2$??
Yes
624
$N + L_1(T_{j-1}) > C_1$??
Yes
No
620
$L_2(T_j) = L_2(T_{j-1}) + N$
No
628
$L_1(T_j) = L_1(T_{j-1}) + N$
To Task Flow Update
608

Fig. 11

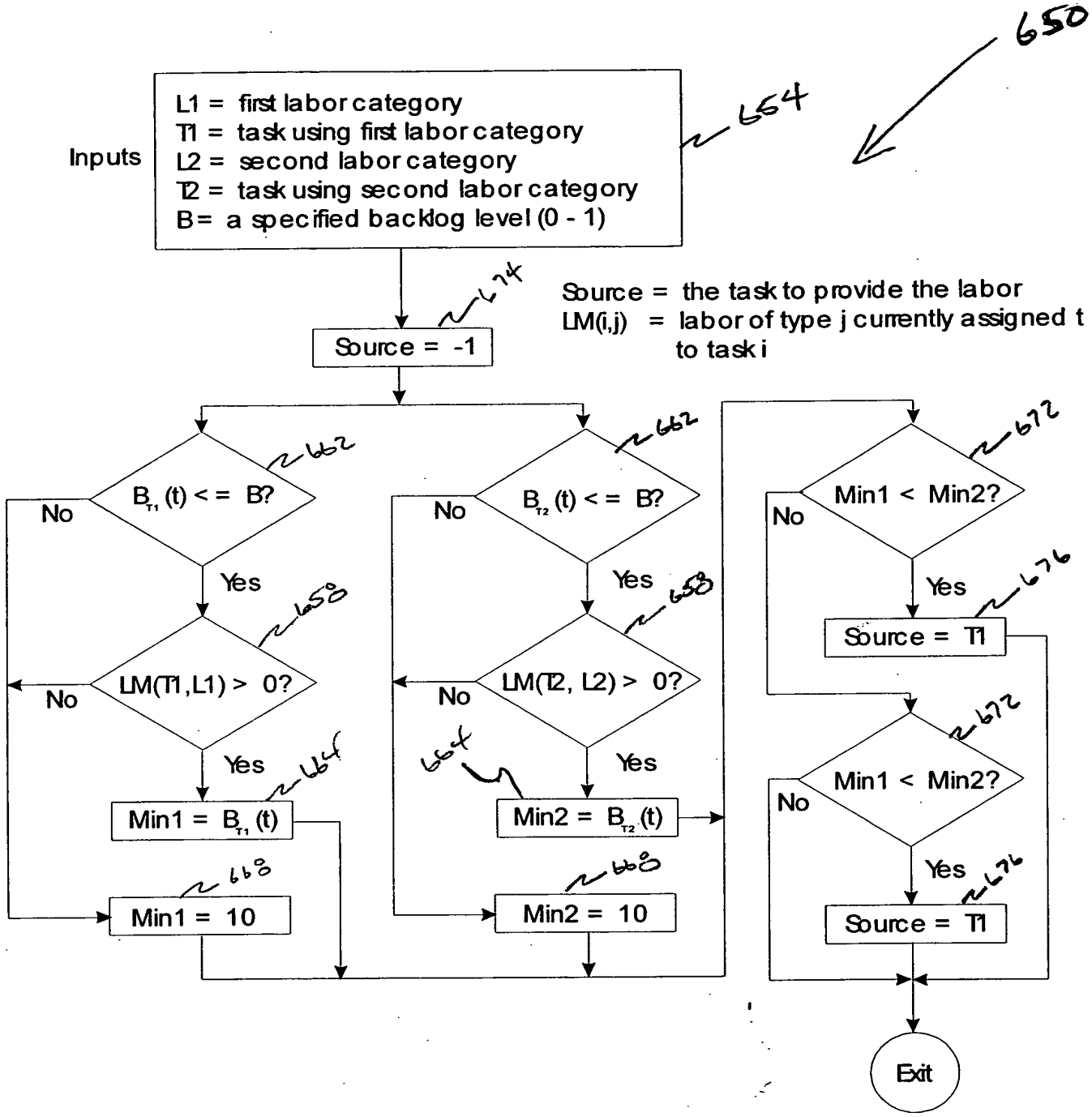
650
Inputs
L1 = first labor category
T1 = task using first labor category
L2 = second labor category
T2 = task using second labor category
B = a specified backlog level (0 - 1)
654
Source = the task to provide the labor
LM(i,j) = labor of type j currently assigned t to task i
674
Source = -1
662
$B_{T1}(t) <= B$?
No
Yes
658
LM(T1,L1) > 0?
No
Yes
664
Min1 = $B_{T1}(t)$
668
Min1 = 10
662
$B_{T2}(t) <= B$?
No
Yes
658
LM(T2, L2) > 0?
No
Yes
664
Min2 = $B_{T2}(t)$
668
Min2 = 10
672
Min1 < Min2?
No
Yes
676
Source = T1
672
Min1 < Min2?
No
Yes
676
Source = T1
Exit

Fig. 12